

Bibliometrics Analysis Using VOS Viewer and Publish or Perish: Trends and Visualization of Soft Computing Research in Deep Learning

^{1*}Enggarani Wahyu Ekaputri, ²Muchammad Alif Zaidan, ³Suhartono

^{1,2,3}UIN Maulana Malik Ibrahim, Malang, Indonesia

*enggaraniwahyu@gmail.com

ABSTRACT

The background of this research is the significant increase in the number of scientific publications related to the use of soft computing in Deep Learning in recent years. As bibliometric data becomes increasingly complex, an effective tool is needed to map and analyze this data. This research aims to provide a step-by-step analysis to make it easier for novice users to follow how to use VOS Viewer. This report enables and facilitates data analysis by utilizing mapping tools and provides an analysis of the development of research on digital learning media. The method used in this research is to conduct bibliometric analysis to produce network visualization of co-work maps and co-work density maps. The analysis was conducted using the number of publications obtained, related to the specified topic, totaling 500 documents in 2017-2021. As a practical example, we evaluate Soft Computing in Deep Learning. This research method involves Deep Learning. The results of this study show significant insights into research trends and developments in digital learning media. The conclusion shows that VOS Viewer can be used to provide suggestions in data analysis results.

Keywords: Bibliometric, Soft Computing, Deep Learning, Clusters

1. INTRODUCTION

Bibliometric analysis is a quantitative methodology used to evaluate scientific publications in a specific field or topic. This method involves analyzing various aspects of publications, such as the number of publications, citations, authorship, and collaboration networks [1][2]. This method aims to identify core studies, authors, and their relationships, providing insights into the research landscape of a particular subject area [3].

Using bibliometric analysis, researchers can map trends, developments, and gaps in the literature, as well as identify potential new knowledge or significant gaps for future research [4]. This analysis helps in understanding the productivity of scientific research, thematic axes, and their evolution over time [5]. Additionally, this analysis allows the identification of core topics within a research domain, facilitating systematic exploration of various aspects within a specific field [6].

Moreover, bibliometric analysis can be used to visualize research trends, such as the evolution of research topics, researcher impact, and the impact of specific papers [7]. This analysis can also provide strategic insights and research directions to advance vital domains, such as the application of deep learning in COVID-19 detection [8].

There has been no research that discusses how to make Bibliometric analysis using VOS Viewer in detail, with several pictures of the steps and examples of analysis regarding Soft Computing in the field of Deep Learning. Therefore, this research was conducted to display the steps of bibliometric data analysis regarding Soft Computing research in the field of Deep Learning using VOS Viewer completely and systematically to see the development of research on this matter from 2017-2021 and provide a straightforward approach to data analysis using mapping tools. The difference between this research and previous research is that it provides a comprehensive, step-by-step guide with detailed visual aids, which has not been carried out by previous research.

Thus, this research aims to be used as a reference for analyzing big data more easily with VOS Viewer. This report can also serve as a reference for first-time users as it provides a step-by-step process when using VOS Viewer. This research method involves Deep Learning techniques. This study contributes to the field by indicating significant insights into the research trends and developments in digital learning media. The conclusion demonstrates that VOS Viewer can be used to provide suggestions in the results of data analysis.

2. RESEARCH METHOD

2.1. Prepare Research Tool

To perform data analysis using VOS Viewer, we need to prepare several applications. First, we use a mapping tool, which can be obtained from the open-source VOSviewer application (Figure 2). In this study, VOS Viewer is used as a tool to visualize and map the analyzed data. The second tool required is a reference management application. Reference management applications that can be used include Publish or Perish, as shown in Figure 3, and Mendeley, as shown in Figure 4. These reference management applications are used to collect research data that will be analyzed bibliometrically using VOS Viewer. Figure 1 illustrates the research flow.

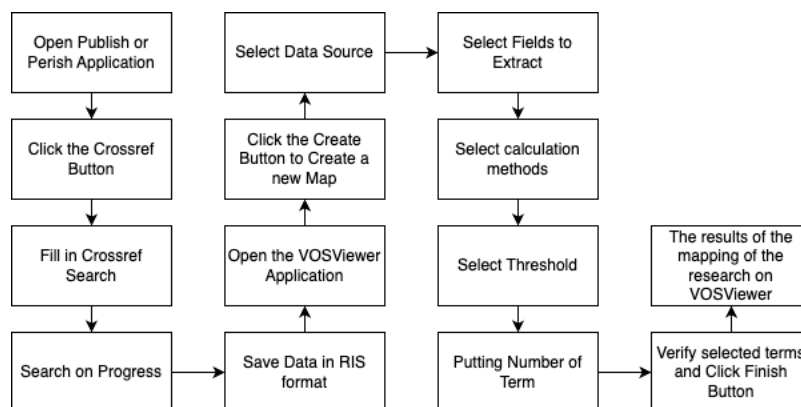


Figure 1. Flow of Research Method

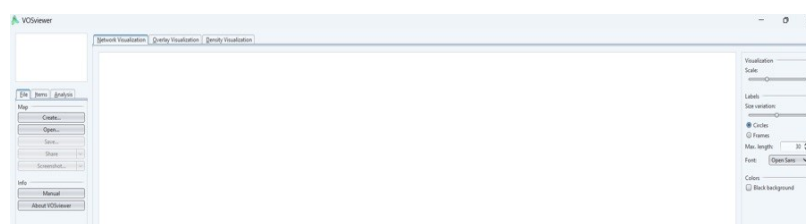


Figure 2. VOS Viewer Application

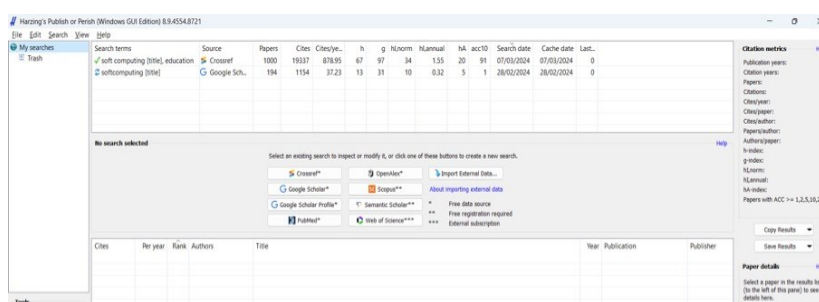


Figure 3. Publish or Perish Application

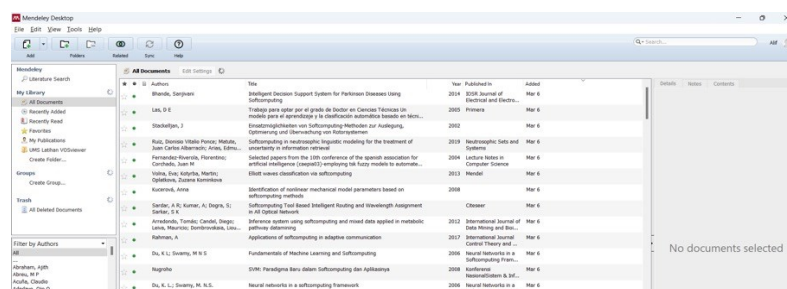


Figure 4. Mendeley Application

2.2. Data retrieval

The data used in this research is the publication data of digital learning media journals in Indonesia obtained by using the reference manager application. The reference manager application used in this research is Publish or Perish. Publish or Perish is used to conduct a literature review of the selected theme. Thus, a database of similar research themes is obtained.

Publish or Perish is used to find out which authors are the most cited, the oldest and latest year of an article and we will get a visualization record of each research to be used. Publish or Perish provides several choices of research data sources to be used such as Crossref, Google Scholar, Google Scholar Profile, PubMed, Microsoft Academic, Scopus, and Web of Science as shown in Figure 5. In this study using data from the Google Scholar database.

2.3. Research Data Mapping

The Data mapping in this study uses a digital mapping application, namely VOS Viewer. The data that has been obtained is processed in such a way as to match the desired keywords. After that the data is inputted into the VOS Viewer application which will then turn the data into an interconnected data map.

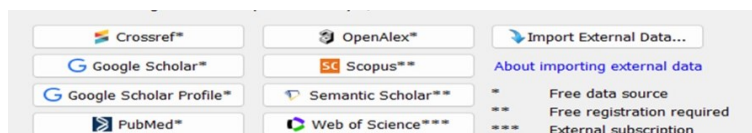


Figure 5. The options for data sources in Publish or Peris

3. RESULT AND ANALYSIS

In this section, we discuss how to analyze the results of data mapping using VOS Viewer with data on the development of the number of journal publications with the main theme of deep learning in the Crossref database from 2017-2021.

3.1. Data Used

As an example of this research, the data will be retrieved through Crossref. This means that any article data contained in Crossref and in accordance with the search themes needed in this study will be backed up into a file that will be used in using VOS Viewer. The steps to get the data are as follows:

A. Open Publish or Perish Application

The first step to get data through publish or perish is to open the application as shown in Figure 6. After it opens or perishes, we can see the initial application window as shown in Figure 7.

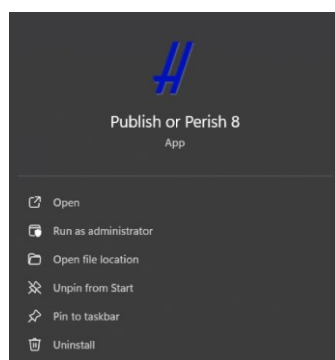


Figure 6. Open Publish or Perish

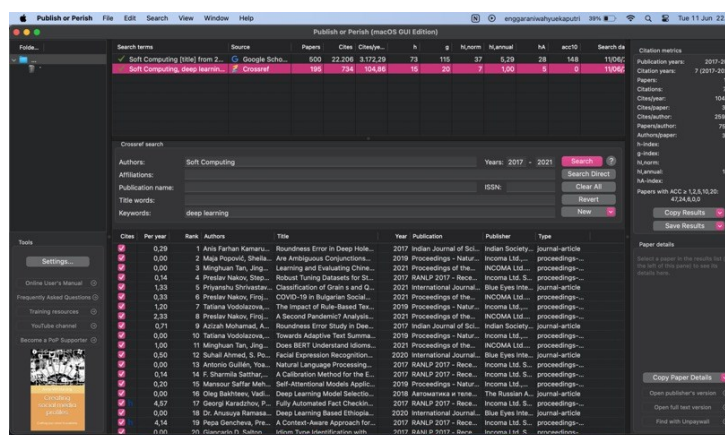


Figure 7. Welcome Screen Publish or Perish

B. Click the Crossref Button

Figure 8 shows the location of the Crossref button in Publish or Perish. At this point, you need to press the button.

C. Fill in the Crossref Search

As shown in Figure 9, there are several fields in the Crossref Search, including author, publication name, title words, and keywords. In this research, the theme searched is soft computing. Fill in the title field with "soft computing" and the keyword field with "deep learning". If the fields in the Crossref search form have been filled in, click the search button in the upper right corner as shown in Figure 9. After the Publish or Perish window appears as shown in Figure 10, wait until the search process is complete.

D. Search Results

Figure 11 shows the search results from Publish or Perish. On the left side of the screen, Figure 11 shows some data information obtained.

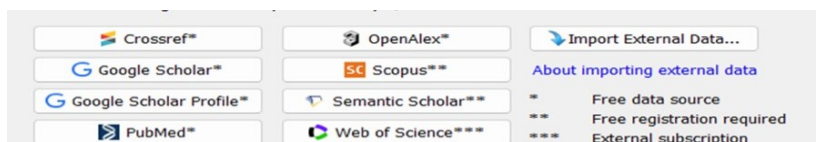


Figure 8. Crossref button

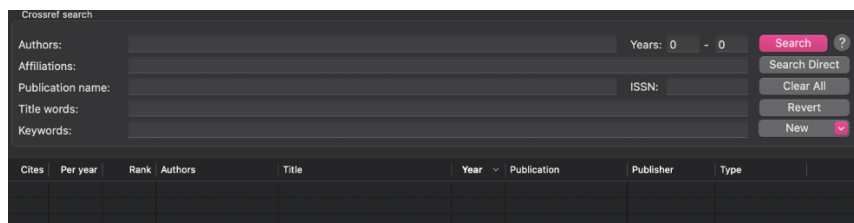


Figure 9. Crossref Search

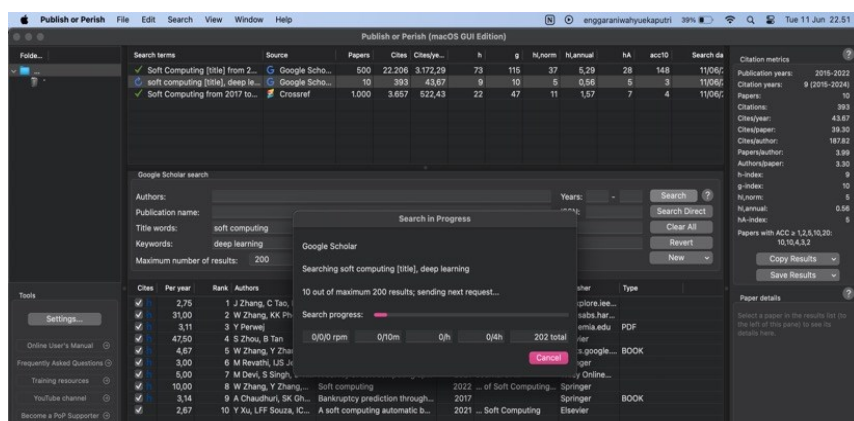


Figure 10. Article search process in Publish or Perish.

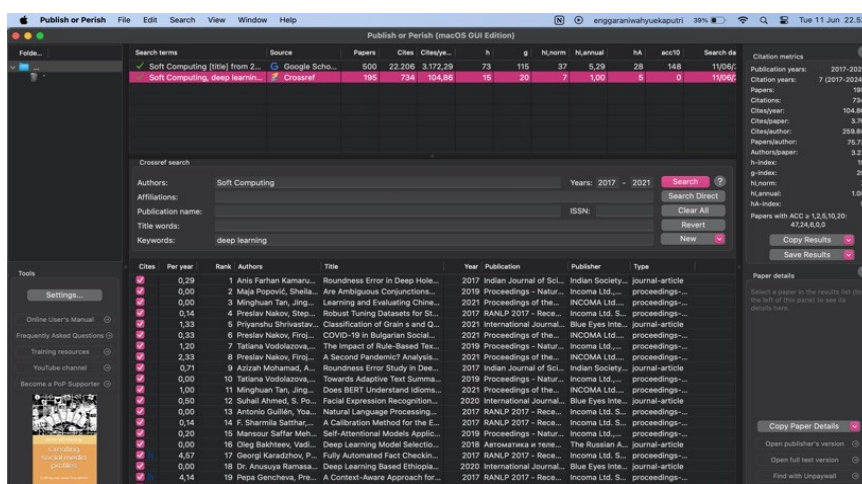


Figure 11. Search results by Publish or Perish

E. Save Data from Publish or Perish

The next step for each saved result is to click the Save Results button. Save the results in RIS format (Figure 12), which can be read by VOS Viewer

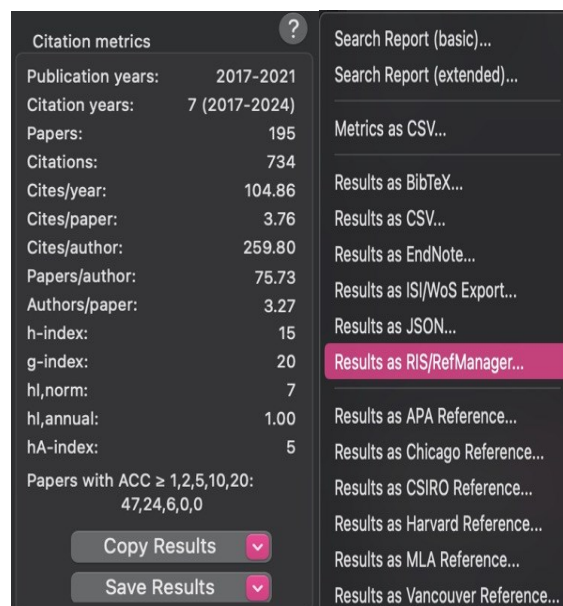


Figure 12. How to save search data Publish or Perish.

Articles found in Publish or Perish are mapped using VOS Viewer. The data displayed in Publish or Perish is in the form of metadata, not full text, including author names, titles, years, journals, and publishers of the articles found. Table 1 shows the search data from Publish or Perish used in the VOS Viewer analysis in this study. The data includes 195 articles, 734 citations, 104.86 citations per year, 3.76 citations per article, 259.80 authors per article, h-index of 15, g-index of 20, annual h-index of 1.00, and annual h-index of 5.

Table 1. Top 10 Metadata

No	Authors	Title	Year	Author Count	Cites	Cites Per Year	Cites Per Author
1	Pepa Gencheva, Preslav Nakov, Lluís Màrquez, Alberto Barrón-Cedeño, Ivan Koychev	A Context-Aware Approach for Detecting Worth-Checking Claims in Political Debates	2017	5	61	8.71	12
2	Yordanka Karayaneva, Diana Hintea	Object Recognition in Python and MNIST Dataset Modification and Recognition with Five Machine Learning Classifiers	2018	2	40	6.67	20
3	Xuefeng Jiang, Yikun Wang, Wenbo Liu, Shuying Li, Junrui Liu	CapsNet, CNN, FCN: Comparative Performance Evaluation for Image Classification	2019	5	37	7.4	7
4	V. Radhamani, G. Dalin	Significance of Artificial Intelligence and Machine Learning Techniques in Smart Cloud Computing: A Review	2019	2	28	5.6	14
5	Yahaya Garba Shawai, Mohammed Amin Almaiah	Malay Language Mobile Learning System (MLMLS) using NFC Technology	2018	2	21	3.5	11

3.2. Development of Publications Regarding Soft Computing in Deep Learning

Based on the search results in the Crossref database, it can be seen that the development of research on Soft Computing in Deep Learning is shown in Table 2. From the table data, it can be seen that there are 195 studies on Soft Computing in Deep Learning. The number of studies on Deep Learning fluctuates but tends to increase, as shown in Figure 12. There was a decrease in research interest

in this theme only in 2020 and 2021, from 72 studies throughout 2019 to 39 studies in 2020 and 37 studies in 2021. The number of studies in 2017 and 2018 was 47, and increased in 2019 with 72.

Table 2. Research on soft computing in Deep Learning

Years of Publication	Number of Publication
2017	25
2018	22
2019	72
2020	39
2021	37
Total	195



Figure 13. Graph of Research

3.3. Bibliometric Mapping Research Regarding Soft Computing in Deep Learning

From the search results through the Crossref database, 195 research documents related to digital learning media were obtained. The documents were then exported into RIS format, imported, and analyzed with VOS Viewer. There are several steps to conduct research mapping using VOS Viewer, which are as follows:

A. Open the VOS Viewer Application

The first step is to open the VOS Viewer application that is already installed on your device. Once opened, the initial VOS Viewer window will appear as shown in Figure 1.

B. Click the Create Button to Start Creating a New Map

After opening VOS Viewer, click "Create" to start creating a new map. As shown in Figure 14, there are three options for the type of data: creating a map based on network data, bibliographic data, and text data. In this study, the map is created based on text data because the research mapping is based on research titles. Then, click "Next."



Figure 14. Create a map in VOS Viewer.

C. Select Data Source

Figure 15 shows the next step in creating the research map, which includes four options for data sources: reading data from VOS Viewer file, a bibliographic database file, a reference manager file, and downloading data via API. In the previous data retrieval stage, we used the Publish or Perish application, which is one of the reference manager applications, and the type of data we saved previously was in RIS format. Therefore, in this section, we choose to read data from the reference manager file, and then click "Next." In the section shown in Figure 16, select the RIS section and insert the file obtained through Publish or Perish by clicking the three-dot button. Then click "Next" to proceed to the next step.

D. Select Fields to Extract

Next, the Select Fields page appears as shown in Figure 17. This page displays three types of data extraction options: title and abstract fields, title field only, and abstract field only. In this study, the title and abstract data from the collected articles are used. Thus, VOS Viewer maps each keyword taken from the titles and abstracts of the collected articles. After completing this step, the next step is to click "Next."

E. Select Calculation Method

Figure 18 shows the selection of the calculation method. There are two methods: binary counting and full counting. Binary counting displays data in the form of 0 or 1 values, which means if the same word appears in the title repeatedly, it is counted

as one. Meanwhile, full counting means that in this method, the total number that appears is still counted as many times as it appears.

F. Select Threshold

Figure 19 shows the Select Threshold page. This page is used to set the minimum number of words that appear so that they can be displayed in a folder. In this study, the minimum number of words that appear is at least 7 times, so keywords that match and appear three times or more are included in the mapping. Then, the number of words found is 24, and for the part shown in Figure 20, we maximize the data display to 24.

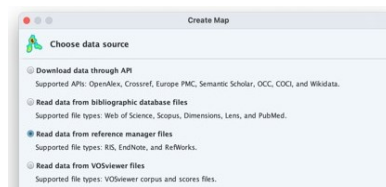


Figure 15. Selection of data sources on VOS Viewer.



Figure 16. Selection of the file to be used as the source of mapping data in VOS Viewer

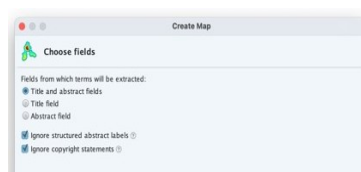


Figure 17. Selection of the type of data to be extracted into a map on VOS Viewer.

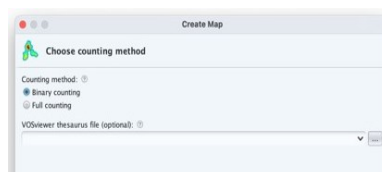


Figure 18. Choosing the counting method in VOS Viewer



Figure 19. Choosing the threshold section on VOS Viewer.



Figure 20. Putting the number of terms.

G. Verify selected terms and Click the Finish Button

In Figure 20, we select the words used and appear on the research mapping created, then click the "Finish" button. After that, we can see the results of mapping the research theme on digital learning media displayed in Figure 21.



Selected	Term	Occurrences	Relevance
☒	better performance	7	2.70
☒	term	10	2.14
☒	case	7	1.92
☒	kind	9	1.68
☒	recall	7	1.61
☒	svm	9	1.55
☒	cloud	7	1.35
☒	naive bayes	8	1.29
☒	patient	7	1.26
☒	disease	9	1.13
☒	covid	7	1.12
☒	classification algorithm	9	0.87
☒	malaysia	9	0.87
☒	day	7	0.80
☒	impact	10	0.78
☒	education	16	0.76
☒	teaching	8	0.69
☒	order	6	0.61
☒	student	27	0.51
☒	survey	6	0.37
☒	need	11	0.31
☒	knowledge	7	0.30
☒	outcome	7	0.16

Figure 21. Verification of word selection on VOS Viewer.

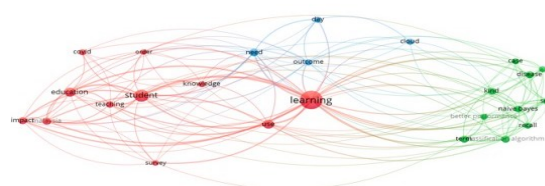


Figure 22. The results of the mapping of the research on VOS Viewer

The results of the keyword network map visualization for the development of research related to soft computing are divided into 3 clusters as shown in Figure 23 below:

Cluster 1. Titled The Impact of the COVID-19 Pandemic on the Learning Process in Malaysia: A Survey of Students and Teachers. The red color consists of 11 items including: covid, education, impact, knowledge, learning, malaysia, order, student, survey, teaching, use. These keywords have been used and discussed in a study entitled An Insight on Sentiment Analysis Research from Text using Deep Learning Methods[9]; Evolution of situational factors in blended learning systems interfaces during COVID-19: An analytical study[10]; An Extensive Survey on Artificial neural Network Based Cancer Prediction Using Soft-Computing Approach[11]; Knowledge Construction Process in Open Learning System among Technical and Vocational Education and Training (TVET) Practitioners[12]; A Second Pandemic? Analysis of Fake News About COVID-19 Vaccines in Qatar[13]; Learning Effectiveness and Efficiency in Tertiary Mathematics Education under Core-and-Spoke Model[14]; The Impact of Orang Asli Students' Learning Styles on Their Achievement of Meaningful Learning[15]; The Impact of Rule-Based Text Generation on the Quality of Abstractive Summaries[16]; A Softcomputing Knowledge Areas Model[17]; A Neural Network Component for Knowledge-Based Semantic Representations of Text[18]; Usefulness of Social Networking Sites towards Malaysian Tertiary Education's Student Life of Learning and Social[19]; Measuring the Impacts of E-Learning on Students' Achievement in Learning Process: An Experience from Tanzanian Public Universities[20]; Mobile Ad Hoc Networks (MANETs) and Mobile Learning (m-Learning): A Survey[21]

Cluster 2. Titled Performance Comparison of Classification Algorithms: Naive Bayes vs SVM in Disease Detection. The green color consists of 10 items, namely: better performance, case, classification algorithm, disease, kind, naive bayes, patient, recall, svm, term. This keyword has been used and discussed in a study entitled Performance of predicting surface quality model using softcomputing, a comparative study of results[22]; Performance Analysis of Supervised Machine Learning Algorithms on Medical Dataset[23]; A Softcomputing Approach for Predicting and Categorising Learner's Performance Using Fuzzy Model[24]; Inclination of Teachers towards Incorporating Mobile Game Based Learning into Primary Education: A Sri Lankan Case Study[25]; An Analysis to Identify the Most Suitable Readability Formula for Sri Lankan Context: Case Study Computer Science Students[26]; Elliott waves classification via softcomputing[27]; Liver Disease Classification using Deep Learning Algorithm[28]; Softcomputing Approach to Virus Diseases Classification Based on CXR Lung Imaging[29]; Recent Advances and Machine Learning Techniques on Sickle Cell Disease[30]; Softcomputing method for diagnosing diabetes patients[31]; Prediction of Patient Readmission via Machine Learning Algorithms[32]; Predicting Type 2 Diabetes A Machine Learning Approach[33]; An Optimized E-Lecture Video Retrieval based on Machine Learning Classification[34], [35]; Support Vector Machine : Paradigma Baru Dalam Softcomputing[36]; SVM: Paradigma Baru dalam Softcomputing dan Aplikasinya[37]; Application of Microarray Technology and Soft computing in Cancer Biology : A Review[38].

Cluster 3. Titled Cloud: Current Needs for Better Results. The blue color consists of 4 items, namely: cloud, day, need, outcome. This keyword has been used and discussed in the research entitled Cloud-based learning service platform for multilingual smart class[34]; Secure Cloud Auditability for Virtual Machines by Adaptive Characterization Using Machine Learning Methods[39]; Significance of Artificial Intelligence and Machine Learning Techniques in Smart Cloud Computing: A Review[40]; A Web-based Learning Programming Portal: Do Instructors Need It to Enhance Novice Students' Computational Thinking Skill?[41]; Bat algorithm based Softcomputing Approach to Perceive Hairline Bone Fracture in Medical X-ray Images[42]; A Systematic Learning on Variety of Recommender Systems for Online Commodities[43]; Time Series Pattern Recognition via SoftComputing[44]; A Three-Layer Privacy Preserving Cloud Storage Scheme Based On Computational Intelligence in Fog Computing[45]; User-Centric Learning for Multiple Access Se-lections[46]; Cloud Based Electronic Program Guide System with Integrated Social Network Recommendations[47]; Interactive Dashboard with Visual Sensing and Zero-Shot Learning Capabilities[48]; Prediction of Rainfall

Induced Landslides using Machine Learning Algorithms[49].

The density cluster visualization is characterized by items that are indicated to be similar to the visible items. The dots of the items are colored depending on the density of the item at that moment. This can identify that the color of the dots is still dependent on the items associated with other items. The Density Co-Word Map is useful to get an overview of the bibliometric map structure by showing which items are considered important to analyze[50]. Based on the research results shown in Figure 23, it can be interpreted that the most frequently used keywords in a publication represent the density map visualization of co-word development research on digital learning media.

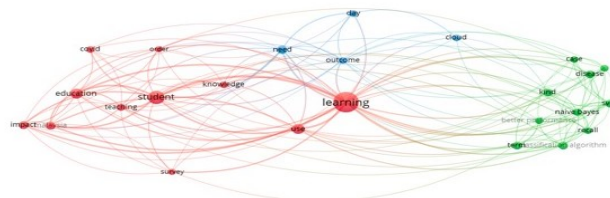


Figure 23. Co-word map network visualization

Figure 24 illustrates the density map which is the result of analysis using all natural language processing articles from 2017 to 2021. Density map means that the more yellow the color with the largest diameter of the circle, the denser the keyword, meaning the more often it appears, and if the color fades and blends with the green background, the less often the keyword appears.

Density maps are effective visualization tools that represent the distribution of scalar fields in a given space. The color intensity and diameter of circles on a density map typically indicate the density of a particular feature or keyword, with brighter and larger circles representing higher frequency or density, while faded colors that blend into the background signify lower occurrence. Various research papers provide insights into the creation and utilization of density maps in different contexts. For example, Density Map is a tool designed to display the density of genomic features along chromosomes, offering customizable color scales for optimal data representation[51].

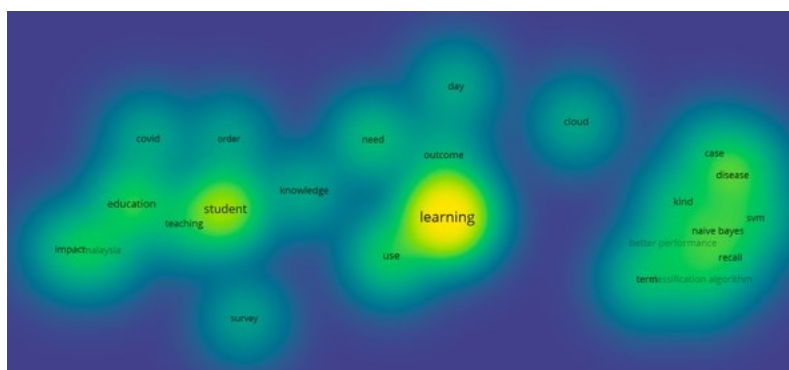


Figure 24. Co-Word Map Density Visualization

4. CONCLUSION

Based on the results and discussion above, it can be concluded that VOS Viewer can be used as a mapping tool for bibliometric data analysis. In this study, the data used for analysis with VOS Viewer is research on Soft Computing in Deep Learning taken from the Crossref database. The number of publications obtained and related to this theme reached 195 documents with a time span from 2017 to 2021. The change in the number of publications during this period fluctuates but tends to increase rapidly from 2019 to 2021. Through network visualization, it can be seen that the research development map on Deep Learning is divided into 3 clusters. Cluster one entitled The Impact of the COVID-19 Pandemic on the Learning Process in Malaysia: A Survey of Students and Teachers consists of 11 topics, cluster two entitled Performance Comparison of Classification Algorithms: Naive Bayes vs SVM in Disease Detection consists of 10 topics, cluster three entitled The Need of the Day for Better Outcomes consists of 4 topics.

This confirms that among these clusters, Cluster One, with 11 topics, is the largest and most significant cluster in terms of research activity. This cluster is titled "The Impact of the COVID-19 Pandemic on the Learning Process in Malaysia: A Survey of Students and Teachers." with keywords: covid, education, impact, knowledge, learning, Malaysia, order, students, survey, teaching and use. The prominence of this cluster indicates the high level of interest and ongoing research efforts in this area. Given the rapid progress and importance of these topics in the field of Deep Learning, it is clear that this cluster has significant potential for future research. Continued exploration and innovation in this cluster is likely to yield valuable insights and advancements, making it a very promising area for ongoing and future research.

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